Journey 1.   Mean of Sydney—Hornsby and Hornsby—Sydney. Difference 18·5 sextant minutes.

Journey 2.   Mean of Sydney—Hornsby and Hornsby—Sydney. Difference 18·1 sextant minutes.

Journey 3.—Mean of Sydney—Hornsby and Hornsby—Sydney. Difference 18·1 sextant minutes.

The maximum difference is thus 0·4 sextant minute, and corresponds to an uncertainty in the value to be assigned to the acceleration of gravity at Hornsby as compared with that at Sydney taken as known of one part in 500,000.   This we believe to fairly represent the accuracy attainable by the instrument in actual field work.   It is about double of the outside accuracy attainable by invariable pendulums, not connected by telegraph, and the observation takes about half an hour, but the time depends on the time required for the temperature to become steady.   The observations quoted took about three hours each. Packing and unpacking takes about an hour and a half, and the actual observing about five minutes, but the temperature must be watched to the maximum or minimum before the observations begin.

The weight of the instrument and of appliances taken directly from the laboratory and packed in strong boxes is 226 lbs.; by making special appliances with a view to lightness this weight might be reduced to one-half.

The paper is illustrated by working drawings, &c.

"Data for the Problem of Evolution in Man.   I. A First Study of the Variability and Correlation of the Hand."   By Miss M. A. WHITELEY, B.Sc., and KARL PEARSON, F.R.S.   Received April 6,—Read April 27, 1899.

1. In a more purely theoretical discussion of the influence of natural selection on the variability and correlation of species, which one of the present writers hopes shortly to publish, a number of theorems are proved which it is desirable to illustrate numerically.   But the quantitative measures of the variability and correlation hitherto published are comparatively few in number, especially when, as in the present case, we desire to have their values for a number of local races of the same species.   When we have once realised that neither variability nor correlation are constant for local races but are modified in a determinate manner by natural selection, and further that their differences are the sure key to the problem of how selection has differentiated local races, then the importance of putting on record all the quantitative measures we can possibly ascertain of variability and correlation becomes apparent.   For some five years past various members of the

Department of Applied Mathematics in University College, London, have, so far as their other work allowed, been collecting and reducing data concerning the variability and correlation of different organs and characters in man. So far as variability is concerned, 160 cases of organs in divers races of man were worked out by Miss Alice Lee, Mr. G. U. Yule, and one of the present writers some years ago,* and since then the more laborious task of measuring the correlation of characters and organs in man has been going steadily forward, until at the present time a considerable mass of material is reduced and ready for publication. The present series of short papers is intended to cover this ground. It will simply state the numerical results reached and any obvious conclusions to be drawn from them, leaving to a later date the consideration of the material as a whole, and in particular its bearing on the general problem of evolution and the relationship of local races of man.

2. This first study deals only with one character of the hand in one sex and one race. A wider range of material on the skeleton of the hand in another local race is already being dealt with. But while the correlation of the anatomically simple parts of the hand is of very great importance, it does not follow that the complex members of the living hand may not be equally, or even more, significant when we have to deal with fitness for the struggle for existence. So far as we have been able to ascertain, although much has been written as to the fitness of the hand for its tasks, no attempt has ever been made to ascertain quantitatively the degree of correlation of its parts.† Hence our first object was to get some idea of the correlation of the parts of the hand from an easily measured and in practice important part. Is the hand as highly correlated as the long bones, or as loosely correlated as the parts of the skull, or does it occupy some intermediate position like that of strength to stature? We accordingly selected as an easily measured but still important character the first joint of the fingers. The measurement therefore covers, besides the fleshy parts, the head of the metacarpal bone together with the proximal phalange. It is thus not anatomically simple, but it probably has much importance for the fitness of the hand, and is a measurement which with a little care can be made with considerable accuracy. Our measurements were taken with a small boxwood spanner graduated to 1/10 inch, and provided

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* A diagram was exhibited at a soirée of the Royal Society three years ago, and we shall be glad to send a photograph of that diagram to any one working at the problem of variation. The data without the diagram are published in a paper on " Variation in Man and Woman," ' The Chances of Death,' vol. 1, pp. 256—277.

† Here, as in other cases, both zoologists and anatomists have since the days of Cuvier, talked a good deal about correlation, but would even to-day be unable to reconstruct, with anything like *quantitative* accuracy, a skeleton from a long bone, a hand from a finger-joint, or a skull from a fragment.

with a vernier, so that the readings could be nominally made to 1/100 inch. Both the hands of 551 women were measured. At first it was proposed to include only those of more than 20 years of age, but no sensible difference was found for the means of those between 18 and 20, and accordingly some sixty or more between these years were included in the final results. While more than a moiety of the measurements and nearly all the laborious arithmetical reductions were made by one of us, Miss M. A. Whiteley, we owe measurements on the students of University, Girton, Newnham, and Westfield Colleges to the energetic assistance of Miss Dorothy Marshall, B.Sc., and a further ninety sets, principally from the students of Bedford College, to Miss Edith Humphrey, B.Sc., to both of whom we wish to acknowledge our great indebtedness.

In the tabulation of results the grouping was done to 1/20 inch, and the means, standard deviations, coefficients of variation, and coefficients of correlation, together with their probable errors, calculated by the processes and formulæ already fully described in papers of the series "Mathematical Contributions to the Theory of Evolution," by one of the present writers. Pianists were specially noted on the data cards, but their numbers did not seem sufficiently large to justify any conclusions as to the effect of use on variability and correlation—a subject which deserves very careful and special investigation.*

The following notation is used :—

R i = first joint of right-hand index finger.
R ii =   ,,   ,,   middle ,,
R iii =   ,,   ,,   ring   ,,
R iv =   ,,   ,,   little ,,
L i =   ,,   left-hand index   ,,
L ii =   ,,   ,,   middle ,,
L iii =   ,,   ,,   ring   ,,
L iv =   ,,   ,,   little ,,

3. *Relative Size of the Hands.*—Turning first to the absolute dimensions of these joints we have, the measurements being in inches :—

Table I.—Lengths of First Joints of Fingers.

	R.	L.
i.	2·2482 ± 0·0030	2·2252 ± 0·0031
ii.	2·3879 ± 0·0033	2·3667 ± 0·0033
iii.	2·2108 ± 0·0031	2·1878 ± 0·0031
iv.	1·8427 ± 0·0028	1·8197 ± 0·0028

* What effect may particular trades or forms of exercise have in modifying the variability of the limbs used and their correlation to other limbs? The relative importance of use and of selection in determining the current values of variability and correlation will one day require very careful investigation.

We conclude at once that these joints in the right hand are very sensibly larger than in the left. In every case there is a difference of about 0·02, and this is many times larger than the probable error of the difference, *i.e.*, $\sqrt{2} \times 0·003$ about.

We might, therefore, conclude that the right hand is larger than the left. This conclusion is directly opposed to that of W. Pfitzner;* he asserts that there is no quantitative difference between right and left for the simple anatomical parts of the hand skeleton. His own measurements, however, really do show such a sensible difference for the *first* phalange. All then we assert at present is that the first joint and the first phalange are larger in the right than in the left hand of women. We prefer to state no more sweeping view at present as to other parts of the hand, however strong our private opinion may be.

4. *Variability of the Hand.*—The following are the numerical results reached :—

Table II.

	Standard deviation.	Coefficient of variation.
R i	0·1055 ± 0·0021	4·6945 ± 0·0954
R ii	0·1133 ± 0·0023	4·7432 ± 0·0964
R iii	0·1091 ± 0·0022	4·9345 ± 0·0100
R iv	0·0986 ± 0·0020	5·3537 ± 0·0109
L i	0·1088 ± 0·0022	4·8917 ± 0·0994
L ii	0·1137 ± 0·0023	4·8033 ± 0·0976
L iii	0·1082 ± 0·0022˙	4·9481 ± 0·0101
L iv	0·0975 ± 0·0020	5·3614 ± 0·0109

If we were to judge by *absolute* variations the index and middle fingers of the right hand are less, the ring and little fingers more variable than those of the left hand. But if we use the more reasonable coefficient of variation, we see that all the first joints for the left hand are more variable than the corresponding joints for the right hand, and this is precisely what we might expect if there be greater adaptation by selection, or by use of the right hand. The greater the selection, the less the variability.

In the left hand the relative order of variability (as measured by the coefficient of variation) is that of the relative size of the fingers ; in the right hand this is slightly modified.† The work has been care-

* Dr. Gustav Schwalbe's 'Morphologische Arbeiten'; W. Pfitzner, 'Das Menschliche Extremitätenskelet,' Bd. I, pp. 21—35, and Bd. II, pp. 99—106, 1892 and 1893.

† The divergence is not one on which real stress can be laid considering the probable error of the coefficient of variation. The hand confirms what we have already learnt from the long bones ('Roy. Soc. Proc.,' vol. 61, pp. 347—348), that 5 per cent. closely measures the variability of the chief parts of the human body.

fully re-done but no error has been discovered. It would thus appear that in the right hand the index finger is less variable than the middle finger. The general order of utility of the fingers would appear to be middle finger, index finger, ring finger, little finger, and this exactly agrees with the order of increasing variability in the left hand. The only doubt about this order appears in the relative efficiency and utility of the middle and index fingers, which have a different order of variability in the right hand.

As all our subjects belonged to the educated classes, it is just possible that the great use of the right hand index finger in writing has something to do with this diversity.

5. *Correlation of the First Finger Joints :—*

Table IV.—Correlation Coefficients.

(*a*) Right Hand.

	R i.	R ii.	R iii.	R iv.
R i ..	1	$0 \cdot 8994 \pm 0 \cdot 0055$	$0 \cdot 8753 \pm 0 \cdot 0067$	$0 \cdot 8173 \pm 0 \cdot 0095$
R ii..	$0 \cdot 8994 \pm 0 \cdot 0055$	1	$0 \cdot 9031 \pm 0 \cdot 0053$	$0 \cdot 8243 \pm 0 \cdot 0092$
R iii..	$0 \cdot 8753 \pm 0 \cdot 0067$	$0 \cdot 9031 \pm 0 \cdot 0053$	1	$0 \cdot 8629 \pm 0 \cdot 0073$
R iv .	$0 \cdot 8173 \pm 0 \cdot 0095$	$0 \cdot 8243 \pm 0 \cdot 0092$	$0 \cdot 8629 \pm 0 \cdot 0073$	1

(*b*) Left Hand.

	L i.	L ii.	L iii.	L iv.
L i ..	1	$0 \cdot 9097 \pm 0 \cdot 0050$	$0 \cdot 8798 \pm 0 \cdot 0065$	$0 \cdot 8204 \pm 0 \cdot 0094$
L ii..	$0 \cdot 9097 \pm 0 \cdot 0050$	1	$0 \cdot 9141 \pm 0 \cdot 0047$	$0 \cdot 8227 \pm 0 \cdot 0093$
L iii .	$0 \cdot 8798 \pm 0 \cdot 0065$	$0 \cdot 9141 \pm 0 \cdot 0047$	1	$0 \cdot 8710 \pm 0 \cdot 0069$
L iv..	$0 \cdot 8204 \pm 0 \cdot 0094$	$0 \cdot 8227 \pm 0 \cdot 0093$	$0 \cdot 8710 \pm 0 \cdot 0069$	1

(*c*) Right and Left Hands.*

	R i.	R ii.	R iii.	R iv.
L i ..	$0 \cdot 9249 \pm 0 \cdot 0042$			
L ii..	..	$0 \cdot 9341 \pm 0 \cdot 0037$		
L iii .	..	..	$0 \cdot 9287 \pm 0 \cdot 0039$	
L iv .	..	..	..	$0 \cdot 9039 \pm 0 \cdot 0053$

* The great labour involved in forming and reducing the seventeen correlation tables of this paper precluded the determination of further right and left-hand correlation coefficients for the present.

Now these tables indicate very important conclusions :—

(i) The hand is a very highly correlated organ, far more highly correlated than the skull and even somewhat more so than the long bones.* We are accustomed to give man precedence in life on account of his brain power, and it might, perhaps, be thought that the brain case would be highly correlated in its parts. Yet what we find is that the skull is extremely individual, its correlations are low and a man could be readily identified by head measurements, whereas hand measurements would be immensely less safe. In other words the hand so far as its dimensions go (we put aside markings) is far closer to a type than the skull.

(ii) The parts of the left hand are distinctly more closely corre lated than those of the right. The only exception is the correlation of R ii and R iv, which is greater than that of L ii and L iv, but the difference here is considerably less than the probable error of the difference, and the general rule appears to be quite certain. Now this is a most remarkable result, but again how is it to be interpreted ? Is it a result of selection or a use effect ? For the same organ it is a rule that the greater the selection the less the variability and the less the correlation. Exceptions there can be, which will be discussed elsewhere, but this appears the general rule. Is the less variability and correlation of the right hand a result of greater selection, or is it after all a result of use ? If the latter we see how hopeless it is to associate constancy of correlation, or even of regression coefficients with the idea of local races. Indeed the further we enter into the quantitative side of the problem of evolution the more important appears the determination of the influence of growth and use on both variability and correlation. Why is the right hand less variable and less highly correlated than the left ? Is the answer the same as to the question : Why is civilised man less variable and less highly correlated than civilised woman ?

(iii) The order of correlation of the first finger joints is identical for both hands. This order is as follows :—

(*a*) The external fingers have the least correlation and the little finger always less than the index.

(*b*) A finger has always more correlation with a second than with any other finger from which it is separated by the second.

Table IV(*c*) exhibits the correlation of corresponding members on both sides. It will be observed that again the extreme pairs show

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* Compare the table on p. 181 of the memoir " On the Reconstruction of the Stature of Prehistoric Races " (' Phil. Trans.,' A, vol. 192). The index and middle finger first joints are more highly correlated than femur and tibia ; the middle and ring finger first joints than humerus and radius, the index and ring finger first joints than femur and humerus.

least correlation, and the pair of middle fingers higher correlation than the pair of ring fingers.

Dr. Warren[*] has been the first to consider the correlation of corresponding right and left parts. He gives for ♀ series of Naqada bones :—

$$\begin{array}{lll}
\text{R and L femur} \dots\dots\dots & 0\cdot9618 & \pm\ 0\cdot0045 \\
\text{R and L tibia} \ \dots\dots\dots & 0\cdot9505 & \pm\ 0\cdot0047 \\
\text{R and L humerus} \dots\dots & 0\cdot9643 & \pm\ 0\cdot0047 \\
\text{R and L radius} \dots\dots\dots & 0\cdot9322 & \pm\ 0\cdot0124
\end{array}$$

Hence we are compelled to conclude that the correlation between corresponding long bones (with the possible exception of that of the radii, which is within the probable error of the value for the middle fingers) is greater than that between corresponding parts of the two hands.

6. *Index Correlations.*—One of the present writers has previously expressed doubts of the validity of using index correlations as a measure of organic correlation.[†] At the same time it may not be without value to put on record the correlations between the finger joints expressed in terms of the first little finger joint as unit.

There are two methods of obtaining index correlations, either directly by forming the actual ratios and then grouping them in correlation tables, or indirectly from the variations and correlations of the absolute quantities by means of the formulæ given in the memoir cited in the footnote. The latter is by far the easier process, but it neglects what are usually small quantities of the third order. In order to justify the use of the latter method, the values of the constants for $i_{14} = R\,i/R\,iv$ and $i_{24} = R\,ii/R\,iv$ were found by both methods. They gave the following results, Σ_{14}, Σ_{24} being the standard deviations of the indices, V_{14}, V_{24} the coefficients of variation, and ρ the coefficient of correlation.

Table V.

	Directly. By correlation table.	Indirectly. By formulæ.	Difference.
i_{14}	1·2216	1·2210	+ 0·0006
i_{24}	1·2970	1·2968	+ 0·0002
Σ_{14}	0·0368	0·0379	− 0·0011
Σ_{24}	0·0389	0·0395	− 0·0006
V_{14}	3·0097	3·1013	− 0·0916
V_{24}	3·0034	3·0487	− 0·0453
ρ	0·7388	0·7631	− 0·0243

* ' Phil. Trans.,' B, vol. 189, p. 178.
† ' Roy. Soc. Proc.,' vol. 60, pp. 489—498.

It will be seen at once that the means and standard deviations obtained by the two methods are very close, but that in the coefficients of variation and correlation there may be a difference of some 3 per cent. Sensible as this is, its amount did not seem to justify the immense additional labour of index correlation tables—until at any rate the biologists have shown what possible use can be made of index correlations for *organic* relationship.

The following results were obtained :—

Table VI.

Index.	Mean value.	Standard deviation.
R i/R iv	1·2210	0·03787
R ii/R iv	1·2968	0·03954
R iii/R iv	1·2004	0·03270
L i/L iv	1·2238	0·03799
L ii/L iv	1·3016	0·04001
L iii/L iv	1·2030	0·03186

It would thus appear that the indices for the left hand are all larger than for the right, or the index, middle and ring fingers relatively larger with respect to the little finger in the left than the right hand. On the whole the variability of the right hand still appears less than that of the left, *i.e.*, two cases against one.

Turning to correlation, the following values were found :—

Table VII.—Total Correlations of Indices.

	Ri/Riv.	Rii/Riv.	Riii/Riv.	Li/Liv.	Lii/Liv.	L ii L iv.	
Ri/Riv	1	0·7631	0·6632	1	0·7774	0·6587	Li/Liv
Rii/Riv	0·7631	1	0·7310	0·7774	1	0·7590	Lii/Liv
Riii/Riv	0·6632	0·7310	1	0·6587	0·7590	1	Liii/Liv

Here, but not so decisively as in the case of absolute magnitudes, the left hand exhibits higher correlation. This higher correlation becomes absolutely decisive, however, if we consider the spurious correlations given below.

Table VIII.—Spurious Correlations of Indices.

	Ri/Riv.	Rii/Riv.	Riii/Riv.	Li/Liv.	Lii/Liv.	Liii/Liv.	
Ri/Riv	1	0·5628	0·5529	1	0·5502	0·5429	Li/Liv
Rii/Riv	0·5628	1	0·5504	0·5502	1	0·5473	Lii/Liv
Riii/Riv	0·5529	0·5504	1	0·5429	0·5473	1	Liii/Liv

In every case the right hand exhibits more *spurious* correlation than the left, and our previous conclusion is thus thoroughly confirmed; the left hand exhibits higher organic correlation of its parts than the right. How is this to be explained ? It is all important that further researches should determine whether it is selection or use which differentiates the two hands. It would be hardly possible to find a sufficiently large group of left-handed persons to mark how far variation and correlation were modified ; but measurements on the hands of children, of the educated and uneducated, and of workmen following particular trades might possibly throw light on the extent to which use modifies correlation.

We append the correlation tables giving the data upon which our numerical values are based.

APPENDIX.

Correlation Tables for First Finger Joints.

I.—Index and Middle Fingers, Right Hand (R i and R ii).

R i →	1·95 to 2·00.	2·00 to 2·05.	2·05 to 2·10.	2·10 to 2·15.	2·15 to 2·20.	2·20 to 2·25.	2·25 to 2·30.	2·30 to 2·35.	2·35 to 2·40.	2·40 to 2·45.	24·5 to 2·50.	2·50 to 2·55.	2·55 to 2·60.	Totals.
2·00—2·05	0·5													0·5
2·05—2·10	0·5		2											2·5
2·10—2·15	2·5	2·5	2	0·5										7·5
2·15—2·20	1	6·5	5·5	3										16
2·20—2·25	0·5	3·5	12·5	15·5	1·5	1·5								35
2·25—2·30		0·5	6	14·5	22	5·5	2							50
2·30—2·35			1·5	12	38·75	31·5	10·75	0·5						94·5
2·35—2·40				2	16	39	28·5	6						91·5
2·40—2·45				0·5	1·25	18·25	47	26	3·5					96·5
2·45—2·50					2·5	2·25	10·5	32·25	17	1				66·5
2·50—2·55					0·5		1·25	16·75	20	11·5	1·5			51·5
2·55—2·60							0·5	0·5	7·75	9·75	2·5			20·5
2·60—2·65									1·25	6·25	4·5	0·5		13
2·65—2·70										2·5	1	0·5		4
2·70—2·75										0·5			1	1·5
Totals	5	13	29·5	48	82·5	98	100·5	82	49·5	31·5	9·5	1	1	551

I —Index and Ring Fingers, Right Hand (R i and R iii).

Ri →	1·95 to 2·00	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	Totals.
1·85—1·90		0·5												0·5
1·90—1·95	1	0·75	1·75											3·5
1·95—2·00	3·25	1	1	0·25	0·5									6
2·00—2·05	0·75	8	10	5·75	2·5	1								29
2·05—2·10		2·75	10·75	19·25	9·25	1·5	0·25	0·25						44
2·10—2·15			3	14·5	35·5	16·25	4	0·25						73·5
2·15—2·20			1·5	6·75	26·5	42·75	22·25	4·25						103·5
2·20—2·25			0·5	1·5	7·25	29·25	39·5	22	2	0·5				103·5
2·25—2·30					0·5	7·25	28	26·25	8·5	2·5				73
2·30—2·35					0·5		4·5	20·25	25·75	6				57
2·35—2·40							1	7·75	10·5	10	2·25			32·5
2·40—2·45								1	1·5	10·25	3·25			16
2·45—2·50									1·25	2·25	3·5	0·5		7
2·50—2·55											0·5	0·5		1
2·55—2·60													1	1
Totals ….	5	13	29·5	48	82·5	98	100·5	82	49·5	31·5	9·5	1	1	551

III.—Index and Little Fingers, Right Hand (R i and R iv).

R i →	1·95 to 2·00	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	Totals.
1·40—1·45	1													1
1·45—1·50														0
1·50—1·55														0
1·55—1·60	2													2
1·60—1·65	1	2·5	4·25	2·25										10
1·65—1·70		5	8·25	8·25	4·25	0·75	0·5							27
1·70—1·75	1	5·5	7·75	13·25	16·25	4·25	2·75	0·25						51
1·75—1·80			7·75	13·25	30·75	25·75	11·5	1·5						90·5
1·80—1·85			1·5	9	18	35·75	30·75	13·5	1					109·5
1·85—1·90				1	11·25	24·5	35·5	21·5	10·5	2·75				107
1·90—1·95				1	2	6	14·75	31·5	18·5	7·75	1·5			83
1·95—2·00							4·25	11·25	14	7·5	0·5			37·5
2·00—2·05						1	0·5	2·5	3·5	9·75	4·25	1		22·5
2·05—2·10									2	3·75	2·75			8·5
2·10—2·15											0·5		1	1·5
Totals....	5	13	29·5	48	82·5	98	100·5	82	49·5	31·5	9·5	1	1	551

IV.—Middle and Ring Fingers, Right Hand (R ii and R iii).

R ii ↓ / R iii →	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	2·60 to 2·65	2·65 to 2·70	2·70 to 2·75	Totals
1·85—1·90			0·25	0·25												0·5
1·90—1·95			2·25	1·25												3·5
1·95—2·00	0·5	0·5	1·5	2·5	0·5	0·25	0·25									6
2·00—2·05		2	2·75	7·25	11·5	5·25	0·25									29
2·05—2·10			0·75	4·75	14·75	15·25	8·5									44
2·10—2·15					7	18·75	39	6·75	1·5	0·5						73·5
2·15—2·20					1·25	9·5	35	39·25	14·5	3·5	0·5					103·5
2·20—2·25						1·5	8·5	38	45	8	2·5					108·5
2·25—2·30						0·5	2	7·5	32·75	21·5	7·75	1				73
2·30—2·35							1		2·25	26·5	23	3·75	1·5			57
2·35—2·40									0·5	5·5	13·75	9·5	1·25	1		32·5
2·40—2·45											3	5	6·75	1		16
2·45—2·50											1	1·25	3·5	1	0·25	7
2·50—2·55														1	0·25	1
2·55—2·60														1	1	1
Totals...	0·5	2·5	7·5	16	35	51	94·5	91·5	96·5	65·5	51·5	20·5	13	4	1·5	551

V. Middle and Little Fingers, Right Hand (R ii and R iv).

R ii ↓ \ R iv →	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	2·60 to 2·65	2·65 to 2·70	2·70 to 2·75	Totals.
1·40—1·45			1													1
1·45—1·50																0
1·50—1·55																0
1·55—1·60	0·5	0·5	1													2
1·60—1·65		0·75	2	4·25	2·75	1										10
1·65—1·70		0·25	3·25	6	12·5	3	4·5		0·5							27
1·70—1·75		1	0·25	5·25	8·75	18	11·25	2·75	1	0·5						51
1·75—1·80				0·5	8·25	15·5	37·25	20·5	7·5	0·5						90·5
1·80—1·85					2·75	9·5	24·0	37	27·25	5	2	1				109·5
1·85—1·90						3	15·75	22·25	34·75	19·75	11	0·5				107
1·90—1·95						1	1·75	7·5	22·75	26	16·25	5·5	1·25	1		83
1·95—2·00								0·5	2·75	12·5	11·25	5·5	4·5	0·5		37·5
2·00—2·05								1		1·25	8	5·75	4·5	1·75	0·25	22·5
2·05—2·10											3	2	2·5	0·75	0·25	8·5
2·10—2·15												0·25	0·25		1	1·5
Totals	0·5	2·5	7·5	16	35	51	94·5	91·5	96·5	65·5	51·5	20·5	13	4	1·5	551

VI. Ring and Little Fingers, Right Hand (R iii and R iv).

R iii →	1·85 to 1·90	1·90 to 1·95	1·95 to 2·00	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	Totals
1·40—1·45			1													1
1·45—1·50																0
1·50—1·55																0
1·55—1·60		1	1													2
1·60—1·65	0·5	2	2	3·5	2											10
1·65—1·70		0·5	0·5	9	11·5	4·5										27
1·70—1·75			1	13·25	16·25	15·25	1	1·75								51
1·75—1·80			0·5	1·75	13·5	28	3·5	9	1·25							90·5
1·80—1·85				1	0·75	21	37	35·75	12·5	0·75						109·5
1·85—1·90				0·5		4·75	35·75	38·25	29	10·75	2					107
1·90—1·95							21·75	18·25	23	26	1·5	4·75	1			83
1·95—2·00							4·5	0·5	6·25	18·5	10·25	7·25	0·75			37·5
2·00—2·05									1	1	6·75	4	2	1	1	22·5
2·05—2·10											10·25		2·75			8·5
2·10—2·15											1·75		0·5			1·5
Totals	0·5	3·5	6	29	44	73·5	103·5	103·5	73	57	32·5	16	7	1	1	551

VII.—Index and Middle Fingers, Left Hand (L i and L ii).

L i →	1·90 to 1·95	1·95 to 2·00	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	Totals
2·00—2·05															0
2·05—2·10	2	1	2												5
2·10—2·15	1	1	6	2											9
2·15—2·20		1	11·75	10·75	1	1									26·5
2·20—2·25			6·5	14·75	13·25	2									36·5
2·25—2·30			0·75	8	34·5	27·5	3·75								74·5
2·30—2·35				1·5	12·25	36·5	37·25	10							97·5
2·35—2·40				0·5	3·5	20·5	38·25	25·75	9	1					98·5
2·40—2·45						2·5	25·75	31·5	18	2·75					80·5
2·45—2·50								7·75	30·25	12	1·5				51·5
2·50—2·55								1	15·75	15·25	6·5	2·5			41
2·55—2·60								0·5	3	5·75	8	0·75			19
2·60—2·65										1·25	4·5	1·75	1		7·5
2·65—2·70											1·5	1			2·5
2·70—2·75											0·5		0·5	0·5	1·5
Totals ……	3	3	27	37·5	64·5	90	105	76·5	76	38	22·5	6	1·5	0·5	551

VIII.—Index and Ring Fingers, Left Hand (Li and Liii).

Li →	1·90 to 1·95	1·95 to 2·00	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	Totals.
1·85—1·90		0·5													0·5
1·90—1·95	1	1·5	2	1											6·5
1·95—2·00	1	0·75	5·75	3·5	0·5	0·5									11
2·00—2·05		0·25	15·25	12·5	9·5	1·5									39
2·05—2·10			3·75	13·5	24·5	8·75	2·25	0·75							53·5
2·10—2·15			0·25	5·5	23·5	38	17·75	6							91
2·15—2·20	1			1·5	6·5	33·25	39·5	22·75	4·5	2					111
2·20—2·25						8	39	27·25	17·5	0·25					92
2·25—2·30							5·5	14·5	26	10	1·5	1			58·5
2·30—2·35							1	3·75	21	15·75	5	1			47·5
2·35—2·40								1·25	6·75	6	7	1			22
2·40—2·45								0·25	0·25	3·75	7·75	2·5	0·5		15
2·45—2·50										0·25	1·25	0·5	1	0·5	3·5
Totals	3	3	27	37·5	64·5	90	105	76·5	76	38	22·5	6	1·5	0·5	551

IX.—Index and Little Fingers, Left Hand (L i and L iv).

L i ↓	1·90 to 1·95	1·95 to 2·00	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	Totals
1·50—1·55	1	1	1												3
1·55—1·60	0·5	1	1	1											4
1·60—1·65	1	0·5	5·5	0·5	4										17·5
1·65—1·70	0·5	0·5	9·75	6·5	8	0·5	1								34
1·70—1·75			5·25	10·25	21·25	3·5	7·25	2							61
1·75—1·80			2·5	9·75	21	14	31·5	10·25	1						107·5
1·80—1·85			1·5	6	7·75	35·75	41·75	27	0·5	4·25					127·5
1·85—1·90				3	1·5	29·25	18	24·5	13	6·5	2·5				86
1·90—1·95				0·5	1	6·5	5·5	10·5	26	12·5	5	1			62
1·95—2·00						0·5		2·25	26	12·5	6·5	1·5	1·5		29·5
2·00—2·05									6·75	1·75	6·5	2·5			13·5
2·05—2·10									2·75	0·5	1·5	1			5
2·10—2·15											0·5			0·5	0·5
Totals	3	3	27	37·5	64·5	90	105	76·5	76	38	22·5	6	1·5	0·5	551

X.—Middle and Ring Fingers, Left Hand (L ii and L iii)

L ii →	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	2·60 to 2·65	2·65 to 2·70	2·70 to 2·75	Totals.
1·85—1·90	0·5														0·5
1·90—1·95	1·5	3·5	0·5	1											6·5
1·95—2·00	1·5	1·5	5·75	2·25											11
2·00—2·05	1·5	4	15·5	13·75	4·25										39
2·05—2·10			3·75	14·75	26·25	6·5	2·25								53·5
2·10—2·15			1	4·75	32	42·25	10·25	1·75							91
2·15—2·20					11·75	39	42	15·25	1	1					111
2·20—2·25					0·25	6·75	39·5	40	4·75	0·75					92
2·25—2·30						3	4·5	19·25	21·75	8·75	1·25				58·5
2·30—2·35								4·25	19·5	18·75	4·25	0·75			47·5
2·35—2·40									4	8·75	5	3·25	0·5		22
2·40—2·45									0·5	3	7·75	2·25	1·5	0·5	15
2·45—2·50											0·75	1·25	0·5	1	3·5
Totals	5	9	26·5	36·5	74·5	97·5	98·5	80·5	51·5	41	19	7·5	2·5	1·5	551

XI.—Middle and Little Fingers, Left Hand (Lii and Liv).

L ii →	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	2·60 to 2·65	2·65 to 2·70	2·70 to 2·75	Totals.
1·50—1·55	1	1	1												3
1·55—1·60	1	1·5	0·5	1											4
1·60—1·65	0·5	2·5	5·5	5	4										17·5
1·65—1·70	2·5	2	6	11·25	9·75	1·5	1								34
1·70—1·75		1	8·5	12·75	17·75	14·75	3·75	2·5							61
1·75—1·80		1	4	3·75	26·75	39·5	22·75	10·5	0·25						107·5
1·80—1·85			1	2·75	12·5	29·5	43·5	25·5	8·75	2	1				127·5
1·85—1·90					2·75	10·5	23	23	15·75	8·5	2·5				86
1·90—1·95					1	1·75	4·5	18·5	17·75	14·5	3	1			62
1·95—2·00								0·5	7·25	11·25	6·5	3	0·5		29·5
2·00—2·05									1·75	3·25	4	2·5	2	0·5	13·5
2·05—2·10										1·5	2	0·5		1	5
2·10—2·15												0·5			0·5
Totals	5	9	26·5	36·5	74·5	97·5	98·5	80·5	51·5	41	19	7·5	2·5	1·5	551

XII.—Ring Finger and Little Finger, Left Hand (L iii and L iv).

L iii →	1·85 to 1·90	1·90 to 1·95	1·95 to 2·00	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	Totals.
1·50—1·55	0·5	1·5	1											3
1·55—1·60		3		1										4
1·60—1·65		2	4·5	7	3·5	0·5								17·5
1·65—1·70			4·5	14	12·5	2·5	0·5							34
1·70—1·75			1	10	20	20	9	1						61
1·75—1·80				4	12	41·75	37·25	11	1·5					107·5
1·80—1·85				3	5·25	21·5	43	42·75	8·5	3	0·5			127·5
1·85—1·90					0·25	3·75	19·25	26·75	24·75	9·25	2			86
1·90—1·95						1	2	10·5	22	21·5	2·5	2·5		62
1·95—2·00									1·75	11·75	12	3·5	0·5	29·5
2·00—2·05										2	4	6	1·5	13·5
2·05—2·10											1	2·5	1·5	5
2·10—2·15												0·5		0·5
Totals	0·5	6·5	11	39	53·5	91	111	92	58·5	47·5	22	15	3·5	551

XIII.—Index Fingers, Right and Left Hands (R i and L i).

R i →	1·95 to 2·00	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 1·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	Totals.
1·90—1·95	1	1												3
1·95—2·00	1	2	1											3
2·00—2·05	1·5	7·5	13	4		1								27
2·05—2·10	1·5	2·5	12	17	3·5	1								37·5
2·10—2·15			3·5	21	32	7	1							64·5
2·15—2·20				4·5	38·75	35·5	9·75	1·5						90
2·20—2·25				1·5	7·25	45·25	45·25	5·25	0·5					105
2·25—2·30					1	8·25	36·5	28·5	2·25					76·5
2·30—2·35							7	41·25	24·5	3·25				76
2·35—2·40							1	5·5	17·75	13·5	0·25			38
2·40—2·45									3·5	12	6·5	0·5		22·5
2·45—2·50									1	2·75	1·75	0·5		6
2·50—2·55											1		0·5	1·5
2·55—2·60													0·5	0·5
Totals ……	5	13	29·5	48	82·5	98	100·5	82	49·5	31·5	9·5	1	1	551

XIV.—Middle Fingers, Right and Left Hands (R ii and L ii).

R ii →	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	2·60 to 2·65	2·65 to 2·70	2·70 to 2·75	Totals.
2·05—2·10	0·5	1	1·5	2												5
2·10—2·15		1·5	3·75	4·25	1											9
2·15—2·20			2·25	8·25	13	1·5										26·5
2·20—2·25				1·5	17·5	13	4·5									36·5
2·25—2·30					3·5	32·5	31·5	5·5	0·5	0·5						74·5
2·30—2·35						2	43·75	43	5·75	3						97
2·35—2·40						1·5	13·75	37·25	41	5	0·5					98·5
2·40—2·45						0·5	1	5·75	44·75	25·5	2·5		0·5			80·5
2·45—2·50									4·5	23·5	21·75	1·25	0·5			51·5
2·50—2·55										8	23·25	7·5	1·25	1		41
2·55—2·60											3·25	9·5	6	0·25		19
2·60—2·65											0·25	2·25	4·75	0·25		7·5
2·65—2·70														2·25	0·25	2·5
2·70—2·75														0·25	1·25	1·5
Totals....	0·5	2·5	7·5	16	35	51	94·5	91·5	96·5	65·5	51·5	20·5	13	4	1·5	551

XV.—Ring Fingers, Right and Left Hands (R iii and L iii).

R iii →	1·85 to 1·90	1·90 to 1·95	1·95 to 2·00	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	2·15 to 2·20	2·20 to 2·25	2·25 to 2·30	2·30 to 2·35	2·35 to 2·40	2·40 to 2·45	2·45 to 2·50	2·50 to 2·55	2·55 to 2·60	Totals.
1·85—1·90	0·5															0·5
1·90—1·95		3	0·5	1	1											6·5
1·95—2·00		0·5	1	6·5	2		0·5									11
2·00—2·05			1·5	16·25	17·25	2·5	1									39
2·05—2·10			2	4·75	18	24·5	5·75									53·5
2·10—2·15			0·5	0·5	4·25	40·5	38·75	5·75	0·75							91
2·15—2·20			0·5		1·5	6	48	43·75	10·25	0·25						111
2·20—2·25							9·5	48·5	31	2·25	1·25					92
2·25—2·30								5·25	26	23·75	0·75	2·5				58·5
2·30—2·35								0·25	5	27	3·5	4·5	4			47·5
2·35—2·40										2·25	12·75	8·25	1·75			22
2·40—2·45										1·5	11·25	0·75	1·25	1	0·5	15
2·45—2·50											3				0·5	3·5
Totals.....	0·5	3·5	6	29	44	73·5	103·5	103·5	73	57	32·5	16	7	1	1	551

XVI.—Little Fingers, Right and Left Hands (Riv and Liv).

Riv →	1·40 to 1·45	1·45 to 1·50	1·50 to 1·55	1·55 to 1·60	1·60 to 1·65	1·65 to 1·70	1·70 to 1·75	1·75 to 1·80	1·80 to 1·85	1·85 to 1·90	1·90 to 1·95	1·95 to 2·00	2·00 to 2·05	2·05 to 2·10	2·10 to 2·15	Totals.
1·50—1·55	1			1	1											3
1·55—1·60				1	2·25	·75										4
1·60—1·65					4·5	9·25	3·75									17·5
1·65—1·70					1·25	13	17	1·75	1							34
1·70—1·75					1	3	21·75	26·75	7·5	0·5	0·5					61
1·75—1·80						1	6	52·75	40·25	6	1·5	0·5				107·5
1·80—1·85							1·5	8·25	48·25	57·25	9	1·75	0·5			127·5
1·85—1·90							1	1	12·5	37·25	33·75	0·5	0·5			86
1·90—1·95										6	35·25	18·25	1	1·5		62
1·95—2·00											3	14·75	9·25	2·5		29·5
2·00—2·05												1·75	10	1·75		13·5
2·05—2·10													1·25	2·25	1·5	5
2·10—2·15														0·5		0·5
Totals....	1	0	0	2	10	27	51	90·5	109·5	107	83	37·5	22·5	8·5	1·5	551

XVII.—Ratios of Index and Middle Finger to Little Finger.

Right hand (Ri/Riv and Rii/Riv).

Ri/Riv →	1·075 to 1·100	1·100 to 1·125	1·125 to 1·150	1·150 to 1·175	1·175 to 1·200	1·200 to 1·225	1·225 to 1·250	1·250 to 1·275	1·275 to 1·300	1·300 to 1·325	1·325 to 1·350	1·350 to 1·375	1·375 to 1·400	Totals
1·125—1·150	0·5	0·5												1
1·150—1·175			1											1
1·175—1·200			0·25	0·25	0·5									1
1·200—1·225			1·25	5·25	2·5									9
1·225—1·250			0·75	16·75	24·25	4·75	0·5							47
1·250—1·275		2	1·25	16·25	35·75	28·25	9·5	1						94
1·275—1·300			1	2	22·5	63	39·5	5·5	1·5					135
1·300—1·325				3	11·5	38	58	26	4	1·5				142
1·325—1·350				1	1	9	32·5	32·5	8	2				87
1·350—1·375							6	8	7	2·25				22
1·375—1·400								2·75	2·5	0·25	1			7·5
1·400—1·425								1·75	0·5		1			2·5
1·425—1·450											0·5			0·5
1·450—1·475											0·5			0·5
1·475—1·500													1	1
Totals	0·5	2·5	5·5	44·5	98	143	146	77·5	23·5	6	3	0	1	551